Research Report 1296

RETRAINING ARMY AVIATORS FOLLOWING A PROTRACTED ABSENCE FROM FLYING

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A group of Individual Ready Reserve (IRR) Utility Helicopter (UH-1) aviators who had not flown for several years was retrained by Army Research Institute (ARI) instructor pilots at the United States Army Aviation Center (USAAVNC). The main emphasis of the training program was on daytime contact maneuvers, the evaluation of which was carried out by Standardization Instructor Pilots (SIPs) for USAAVNC. Conclusions are drawn about the optimum nature and content of the training program, the hours required to reach a satisfactory standard, and the relationship between the training hours

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required, total flying time and years away from flying.

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RETRAINING ARMY AVIATORS FOLLOWING A PROTRACTED ABSENCE FROM FLYING

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Human Factors in Training

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RETRAINING ARMY AVIATORS FOLLOWING A PROTRACTED ABSENCE FROM FLYING

BRIEF

Requirement:

To devise and use a program for retraining IRR UH-1 aviators and to determine the training required in relation to total military flight hours and time away from flying.

Procedure:

Twenty-four aviators in four successive groups were retrained and evaluated at USAAVNC over the course of one year. Although the training program was improved between groups, the in-flight evaluation procedure remained the same. Data from 17 of the aviators were used as a basis for the findings.

Findings:

An average of just over 13 hours of flight training time was required to bring the aviators to criterion, this figure correlating negatively with total flight hours and positively with years away from flying.

Utilization of Findings:

The POI developed in this experiment is currently being used in all Army units where IRR aviators are being trained. The findings on required flying hours are being used in the determination of optimum tour lengths.

FOREWORD

The Army Research Institute for the Behavioral and Social Sciences (ARI) Field Unit at Fort Rucker, Alabama, provides support to the US Army Aviation Center (USAAVNC) in the area of aviation training research and development. The research reported in this document was performed as part of a project on "Army Aviator Skill Maintenance, Loss and Recovery," sponsored by the Director of Army Training, Deputy Chief of Staff for Operations (DAT-DCSOPS) under Human Resources Need (HRN) 80-4. This work forms part of the overall project, "Human Factors in Training and Operational Effectiveness."

The evaluation of the aviators' performance was conducted by Standardization Instructor Pilots (SIPs) from the Directorate of Evaluation and Standardization (DES) at USAAVNC and their training by Major Paul DesJardins, Mr. Hans Langhammer, CW3 Carl Everhart, and CW2 Bernie Sundy of ARI and Mr. Charles Carr of Canyon Research Group, Inc. Administrative arrangements were made by Major Steven Wallace of Headquarters, Reserve Components Personnel and Administration Center (HQ RCPAC) and Major Bill Squire of Directorate of Reserve Components, USAAVNC. Mr. Chester Holland, Flight Simulator Division, Department of Academic Training (DOAT) and CW3 Dan Shaver, Hanchey Division, Department of Flight Training (DOFT) were the instructors for the AH-1 part of the Program. The Authors gratefully acknowledge the outstanding contribution made by all these individuals and wish to thank them and their managers for their support of this Program.

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RETRAINING ARMY AVIATORS FOLLOWING A PROTRACTED ABSENCE FROM FLYING

CONTENTS

	Page
INTRODUCTION	1
OBJECTIVES	3
PILOT STUDY	3
Method	3
Results	3
Discussion	3
METHOD	4
Subjects	4
Evaluators	4
Trainers	4
Measures	4
RESULTS AND ANALYSIS	6
Evaluators and IPs' Comments	15
Reservists' Comments	15
DISCUSSION	16
CONCLUSIONS	18
REFERENCES	19
APPENDIXES	
Appendix A. Training IRR Aviators for the Attack Mission	20
B. Interim Gunnery POI	25
C. Aviator Proficiency Tasks	27
D. Flight Skills Rating Form	28
E. Daily Training Calendar	31

TABLES

		Page
Table 1.	Checkride Scores	7
2.	Hours to Criterion (Estimated)	7
3.	Estimated vs Actual Further Hours Required	7
4.	Return and Final Checkride Scores	14
5.	Academic Tests (Open-ended)	14
6.	Academic Tests (Multiple Choice)	15

FIGURES

Figure 1.	Hours to Criterion (70%) vs Predicted Hours	9
2.	Hours to Criterion (70%) vs Total Military Flight Hours	10
3.	Hours to Criterion (70%) vs Years Away	11
4.	Hours to Criterion (70%) by Total Military Flight Hours and Years Away	12
5.	Return Checkride vs Final Checkride	13
A-1.	Final Gunnery Proficiency	23

RETRAINING ARMY AVIATORS FOLLOWING A PROTRACTED ABSENCE FROM FLYING

INTRODUCTION

In 1978, the Department of the Army (DA) initiated the Individual Ready Reserve (IRR) Aviator Training Program. Individual Reserve aviators, who had been away from military flying for a number of years, were attached to active Army units for brief training periods in order to prepare them as valuable mobilization assets. In order to maximize the cost-effectiveness of this program, DA needed a rapid response to the question of the extent to which the flying skills of these aviators had deteriorated. They also needed to know the nature and amount of training necessary to correct this deficiency, and then to maintain the Reservist's skill at a satisfactory level. At the same time, the Army Research Institute (ARI) Field Unit at Fort Rucker, had been tasked by the Deputy Chief of Staff for Operations (DCSOPS) under Human Resources Need (HRN) 80-4, to investigate this problem for Active Army aviators who were returning to flying status after one or more non-flying assignments. Consequently, in July 1979, DCSOPS, Forces Command (FORSCOM), the Reserve Component Personnel and Administrative Center (RCPAC) and ARI agreed that ARI's effort should be concentrated initially in one area, specifically the IRR Program.

Information relevant to this retraining paradigm was sought from four sources: the literature, other Services, the Active Army, and the Reserve. There are relevant studies in the literature which give general guidance about retraining strategy, but none are helpful in determining how much retraining is required, or exactly how total flight hours or years away from flying would affect this figure. Thus, in an extensive review of the literature, Prophet (1976) concluded that basic flight control skills (motor) are retained well over extended periods of non-flying, while instrument and procedural skills are retained less well. He notes that, "the extent and manner of degradation of tactical flight skills and higher order flight skills are largely unknown." Schendel, et al (1978), in a general review of retention of motor skills, confirm that procedural skills are lost quickly, whereas continuous control tasks hold up much better. They also observe that, "the single most important determinant of motor retention is the level of original learning." This latter finding is confirmed by Naylor and Briggs (1961) and Gardlin and Sitterly (1978). Many other factors, such as the length of the no-practice period, the type of tasks and the nature of intervening activities may influence retention.

The experience of the other Services is not particularly germane to the IRR situation, as the Air Force and Navy often retrain their returning aviators onto a new aircraft type, thereby confounding old and new learning. However, a study of returning Vietnam POWs indicated that retraining time on aircraft which they had previously flown should be fairly short, particularly for those with high experience levels (Smith and Matheny, 1976). In a review of the literature on cognitive pre-training and the maintenance of flying skills, Smith (1980) reports that the Air Force currently has two major research programs in this area. One, being conducted at the US Air Force Academy, Colorado,

is concentrated on the maintenance of flying skills during non-flying assignments; whereas the other, at the Human Resources Laboratory at Williams AFB, is concentrated on reacquisition training following the loss of these skills. Both studies may well provide much useful information when they are completed in the 1982-83 timeframe.

The primary objective of the refresher course conducted at USAAVNC for the Active Army is renewal of instrument qualification; most aviators achieving this in the 18 hours in-flight and 12 hours simulator time that is allowed. However, the primary concern in the IRR situation is contact flying, and any extrapolation from instrument to contact flying must be made with much care. Lastly, although 28 IRR aviators participated in the program in FY 78, and 350 were scheduled for FY 79, they were not subjected to a common training and assessment program. Individual experience varied greatly and the only information to be derived from their training was informal feedback to RCPAC.

Although data from other sources suggested that retraining should be accomplished fairly easily, gave some guidance as to which skills were likely to deteriorate most (more complex, procedural ones) and emphasized that original level of learning was probably a critical variable, many questions about the amount and manner of retraining remained unanswered. Thus, it was decided to attack the problem in two ways: to survey the IRR aviators who were training with active Army units to see how much training they required (this work is reported separately, Allnutt, 1980), and to train a group of aviators at Fort Rucker and use them as a test-bed for developing training and assessment procedures. A description of this activity forms the substance of this report.

A fundamental decision that had to be taken before the amount of training required could be investigated was the criterion for successful retraining. FORSCOM decided that, solely for the purposes of this investigation, they would deem an aviator retrained when he could pass an Annual Aviator Proficiency and Readiness Test (AAPART) checkride, excluding tactical and instrument proficiency. They gave the training priority as: day contact flight and then, if time permitted, night, Nap-of-the-Earth (NOE), tactical instruments and full instruments. Having established the criterion, the objective was to find out how much training the IRR aviator needed to reach this level, and how best to train him. The latter objective involved devising and developing a training program and assessment system with the aim of it being used in the future by all active Army units which conduct training for IRR aviators. Thus, a primary constraint on the training program and assssment system was that they must be exportable and not based on facilities unique to ARI or Fort Rucker.

Limited resources and a very tight timeframe precluded the careful task analysis and development of a total program which would have been the optimum procedure. Rather, the program was developed in a series of iterations. The first four subjects were treated as a pilot group and major changes to the program made at the end of their training. Although improvements to the program were made throughout the rest of the experiment, they were considered to be sufficiently small to allow the remaining Reservists to be considered as one group.

One part of the experiment is dealt with in a separate self-contained section. This is an investigation of the possibility of converting UH-1 aviators to the role of AH-1 copilot/gunner. FORSCOM expressed serious concern about a major shortfall of AH-1 copilot/gunners and tasked ARI with seeing how long it would take to convert a UH-1 aviator to this position. A report of this work appears in Appendix 1.

OBJECTIVES

The three main objectives of this investigation were to:

(1) determine the amount of (re)training needed to bring an IRR aviator who had not flown for several years up to AAPART contact checkride standards,

(2) establish the variables which affect this figure, and

(3) devise and develop an exportable training and evaluation program to bring him to this level.

PILOT STUDY

Method

Four Reservists were posted to ARI shortly after the project was initiated. This group served as subjects in a pilot study in which training and evaluation procedures were evolved.

The total military flight hours of the group averaged 1160 (range 750-1660) and they had not flown an aircraft for an average of 5 years (range 2-8 years). The initial program was devised by a group of Subject Matter Experts (SMEs) going through the task list extracted by FORSCOM from the Aircrew Training Manual (ATM) (Appendix C). Financial constraints determined that a Reservist should not fly more than once a day. In 12 training days, they flew 10.5 hours dual instruction in the air (which included two checkrides), 6 hours in the UH-1 simulator (SFTS) and studied for 36 hours in the classroom. At the end of the period, they and their IPs were extensively debriefed.

Results

Two of the Reservists passed (70%) an AAPART contact checkride (excluding the oral) at the end of the training period. Their performance on pre- and post-training academic tests had improved markedly, and they and their IPs had numerous suggestions as to how the program could be improved.

Discussion

The initial training and evaluation program had to be assembled very quickly and it was modified extensively both during and after the pilot study. Although the overall format proved to be fairly satisfactory, individual lessons were changed extensively, new ones added, and unnecessary ones eliminated.

METHOD

Subjects

Twenty IRR aviators in successive groups of six, six, and eight acted as subjects for the main phase of the program. Although the groups were trained some months apart, and some changes were made to the training program in the intervals, the in-flight evaluation procedure remained the same. Thus, with appropriate caveats as to the interpretation of the data, it was decided to treat these subjects as one group.

The total military flight hours of the 17 aviators on whom the data are based (see Results and Analysis Section, Para a) averaged 1292 (range 400-2500) hours, and their average time away from military flying was 6.0 (range 2-9) years. One had previously been an IP and none had done any significant civilian flying. They had been engaged in a variety of civilian occupations, only one of which was aviation related (civilian ATC).

The selection of the subjects by RCPAC was based largely on administrative factors; the only limitation imposed by ARI was that they had not done any significant civilian flying since leaving the military. Tour lengths varied between 11 and 22 training days.

Evaluators

Pre- and post-training checkrides were conducted by Standardization Instructor Pilots (SIPs) from the Directorate of Evaluation and Standardization (DES) at USAAVNC. Whenever administratively possible, an aviator had the same SIP for both checkrides. During the planning phase, the SIPs met with ARI staff to discuss the evaluation procedure.

Trainers

All flight and SFTS training, and the great majority of ground instruction, was conducted by five ARI IPs. These IPs had an average of 1410 hours (range 50-2080) hours as IPs, and their total military flight experience averaged 3020 (range 1300-4500) hours. Training was two on one, an IP teaching the same two students for the length of their training period. A very small part of the ground instruction was given by another member of ARI's staff.

Measures

a. Checkride. At the start and end of training each Reservist was given an AAPART contact checkride (which included the oral examination). The Evaluator completed a standard gradeslip (DA Form 4507-R, 1 and 2) and gave the Reservist a percentage score for the ride (70% being the passing grade). If the Reservist failed the checkride, the Evaluator made a written estimate of the additional flight training hours which would be required before the Reservist would reach the 70% level. During the initial checkride, the Reservist's future IP sat in the rear of the aircraft and filled in a diagnostic form (Appendix D) detailing performance deficiencies.

b. Training flights. The standard gradeslip was used for all training flights.

c. Academic tests. On the first and tenth (seventeenth for 5 Subjects - see Results Section, Para k) day of training, each Reservist completed three academic tests. These were:

(1) UH-1 Aircraft Systems Test (40 item).

(2) Aviation Knowledge Test (50 item).

(3) Dead Reckoning Navigation and Tactical Instruments Test (40 item).

These tests were created for this program by ARI IPs and other staff and covered basic AAPART topics. There were two versions of each test, but shortage of time precluded their being matched on anything other than face validity. Half of the Reservists completed one version in the Pre-test, the other half completed the other version. The original versions of these tests were open-ended, whereas those given to later groups were converted to a multiple-choice format ready for exportation to the field. All tests were closed book; there was no time limit for their completion. Scores were given to each Reservist as soon as his tests were marked.

d. Overall Design of the Training and Evaluation Program. The following factors determined the design of the training and evaluation program:

(1) Information obtained from the pilot study.

(2) The requirement to obtain diagnostic information at the beginning and end of a Reservist's tour (i.e., to provide a measure of how far his skills and knowledge had decayed during his time away from flying and how much they had recovered during (re)training).

(3) The financial (and probably, fatigue) constraint limiting each Reservist to one flight a day.

(4) The need for all training materials to be exportable.

(5) The requirement to cover the tasks listed in the ATM.

(6) The priority set by FORSCOM of day, night, NOE, tactical instruments and full instruments. It should be noted here that the flying hours had to be devoted almost exclusively to daytime contact flight and so very little night or NOE training was attempted. However, the SFTS was available and so some basic instrument and tactical instrument training was accomplished.

(7) The Reservists were available for varying tour lengths and so proceeded through the program for as many days as they could spare, taking the final diagnostic tests as near the end as possible.

The program evolved through a series of iterations and, as reported earlier, major changes were made after the first four subjects had been trained. After that, only small modifications were made. The timetable and lesson outline from the final iteration of the program appears in Appendix E.

e. Procedure. On completion of administrative in-processing procedures, each Reservist was briefed on the Program and exhorted to study intensively and strive to pass a checkride before the completion of his tour. Motivation was almost entirely self-generated or a function of IP encouragement, although the last group of Reservists was given a certificate for successful completion of the checkride. The Reservist completed a short questionnaire in which information from RCPAC about his previous flight history and intervening civilian activities was confirmed. Any discrepancies were discussed. The evaluation and training program then proceeded according to the timetable.

Each Reservist was allocated to an IP. When the constraints of IP availability and rank had been met, the allocation decision was made on the basis of the more experienced IPs taking the Reservists who had been away from flying for the longest time. Classroom instruction was divided between the IPs according to their special skills. One lecture was carried out by a psychologist from ARI. On completion of the project, each Reservist and IP was debriefed on his experience.

In an effort to provide comparative data, the academic tests were given to 28 members of the Warrant Officers' Advanced Course at USAAVNC. Most of these officers had just come from aviation assignments in the field and were considered to be representative of current, experienced military aviators. Their total flight time (cf Reservists 1292) averaged 1740 hours (range 800-3600 hours) with an average Time in Service of 8.4 years (range 5-14 years).

Each Reservist agreed to return for further testing at a later date. Some have already done so and will be tested again after an even longer time interval, some have yet to be retested, and some are no longer available (see Results and Analysis Section, Para j).

RESULTS AND ANALYSIS

a. Data Base. The data from three Reservists are not included in the analysis. For two of them, there were administrative difficulties surrounding their final checkride and, for the third, it transpired that he had recently carried out considerable civilian helicopter flying. Thus, unless otherwise stated, a sample size of 17 has been used in the analysis.

b. Hours Flown. The average number of hours flown (including checkrides, but excluding flying done on return several months later) was 20.5 hours (range 13.2 - 25.5 hours).

c. Checkride Scores. The checkride scores are summarized in Table 1.

Table 1

Checkride Scores

(Max = 100, Pass = 70)

	Initial	Final
Average	46.1	79.4
SD	17.1	8.2
Range	10-60	60-91
N	17	17

d. Hours to Criterion (70% on Checkride). Administrative factors necessitated checkrides being taken only at the beginning and end of training, rather than when the IP thought that the Reservist was ready. Therefore, an estimate of the flight training hours required to reach criterion was made from the initial and final checkride scores (assuming linearity between score and flight hours). If a Reservist failed to reach criterion on his final checkride, the hours to reach criterion were obtained by extrapolation. A summary of the data appears in Table 2.

Table 2

Hours to Criterion (Estimated)	
Average	13.3
SD	5.1
Range	4.1-19.0
Median	16.1
N	17

e. Estimated versus Actual Hours Required. At the completion of each Reservist's initial checkride, the Evaluator made a written estimate of the further flight training hours required before the Reservist would reach criterion. The estimated and actual hours required are shown in Table 3. (N.B. The figures are lower than those shown in Table 2 as the time for the initial checkride has been subtracted.)

Table 3

Estimated versus Actual Further hours Required

	Estimated	Actual
Average	13.9	11.8
SD	5.4	5.1
Range	7-25	2.6-17.5
N	17	17

A Pearson Product-Moment correlation between estimated and actual flight training hours required to reach criterion was positive:

$$r = 0.71 \quad (p < 0.01)$$

The relationship between estimated and actual flight training hours required to reach criterion is shown graphically in Figure 1.

f. Experience and Hours to Criterion. A Pearson Product-Moment correlation between total military flight hours and flight training hours to criterion (estimated) was negative:

$$r = -0.67 \quad (p < 0.01)$$

The relationship is shown graphically in Figure 2.

g. Years Away and Hours to Criterion. A Pearson Product-Moment correlation between years away from flying and flight training hours to criterion (estimated) was positive:

$$r = 0.68 \quad (p < 0.01)$$

The relationship is shown graphically in Figure 3.

h. Experience and Years Away versus Hours to Criterion. A regression equation in which flight training hours to achieve criterion are predicted by a combination of total military flight hours and years away was plotted out in an expectancy chart (Figure 4). The chart is read by entering it on the Years Away scale, moving up until reaching the line representing the Total Flight Hours and reading the estimate of the hours to criterion on the vertical scale.

i. Instrument Checkride. Although not an official part of the Program, three Reservists took and passed an instrument checkride in their own time at the end of the training period.

j. Return 3-5 Months Later. Eight of the 17 Reservists returned to ARI for testing 3-5 months after completing their training. Of the others, two have joined the Active Army or National Guard, one has become a civilian flying instructor, one is unavailable for further study, and five are scheduled to return at a later date.

The return schedule, which was determined by the Reservists' availability, was:

Average interval before return	107 days
Range	85-147 days

Each Reservist took a checkride on the morning of his return. These scores, the final checkride score for these Reservists, and the changes are shown in Table 4 and Figure 5.

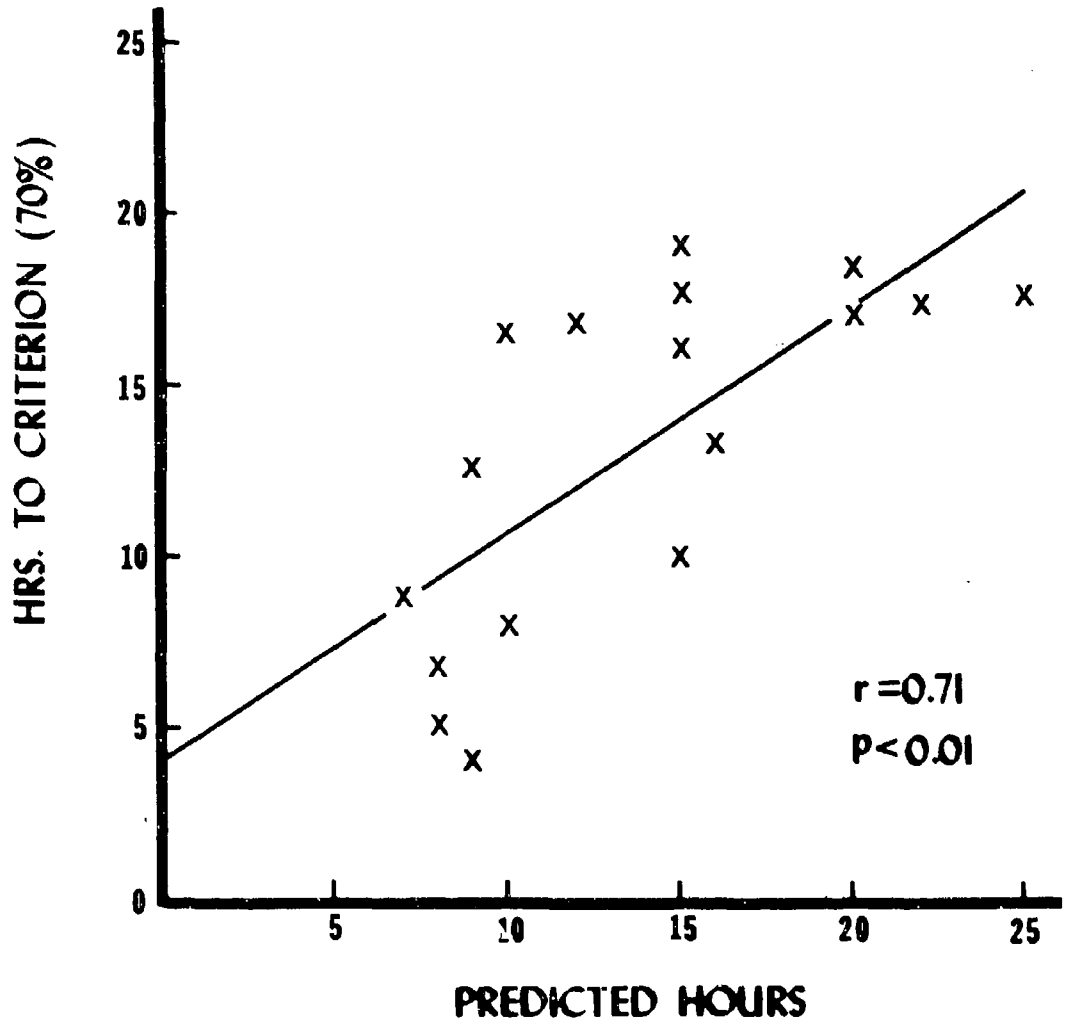

Figure 1. HOURS TO CRITERION (70%) VERSUS PREDICTED HOURS

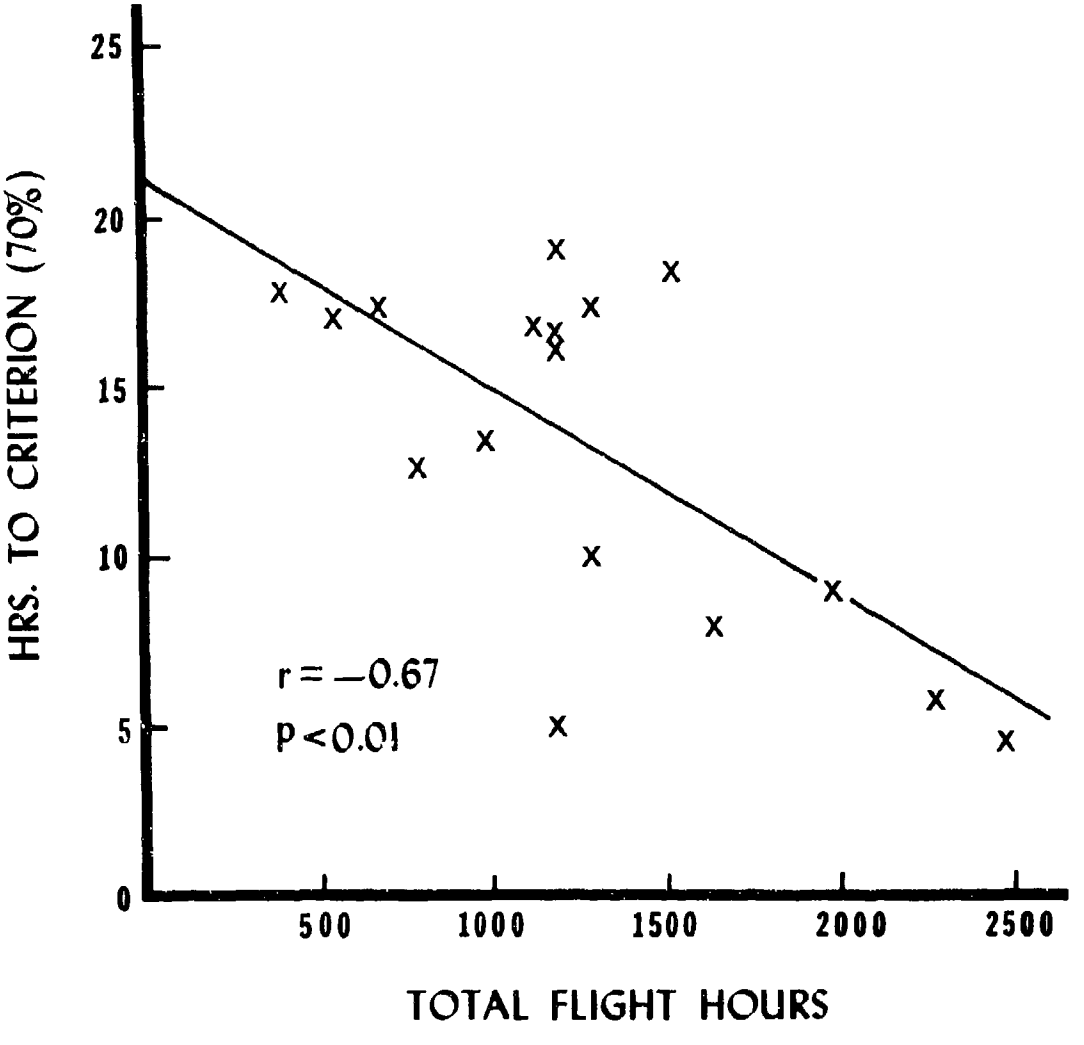

Figure 2. HOURS TO CRITERION (70%) VERSUS TOTAL MILITARY FLIGHT HOURS

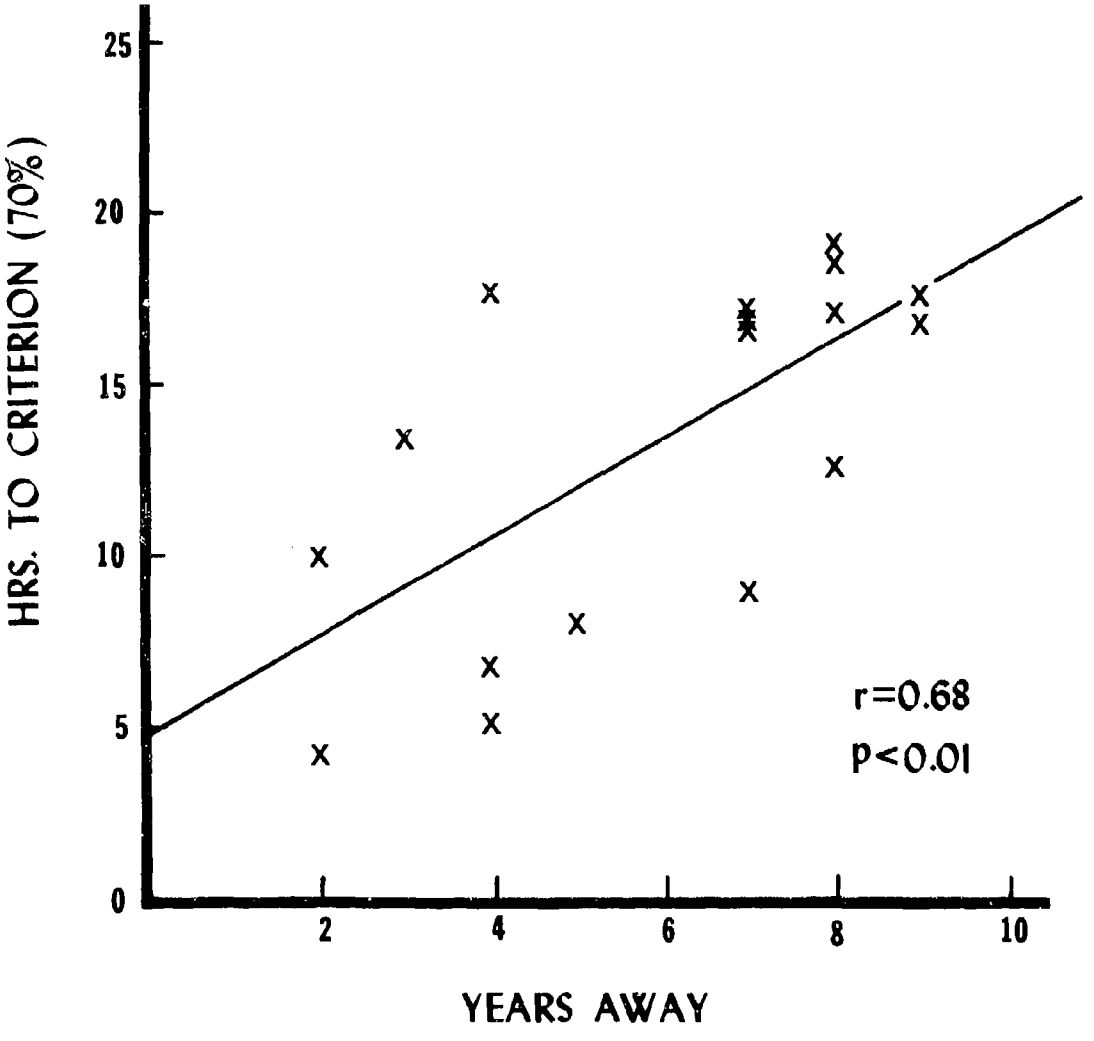

Figure 3. HOURS TO CRITERION (70%) VERSUS YEARS AWAY

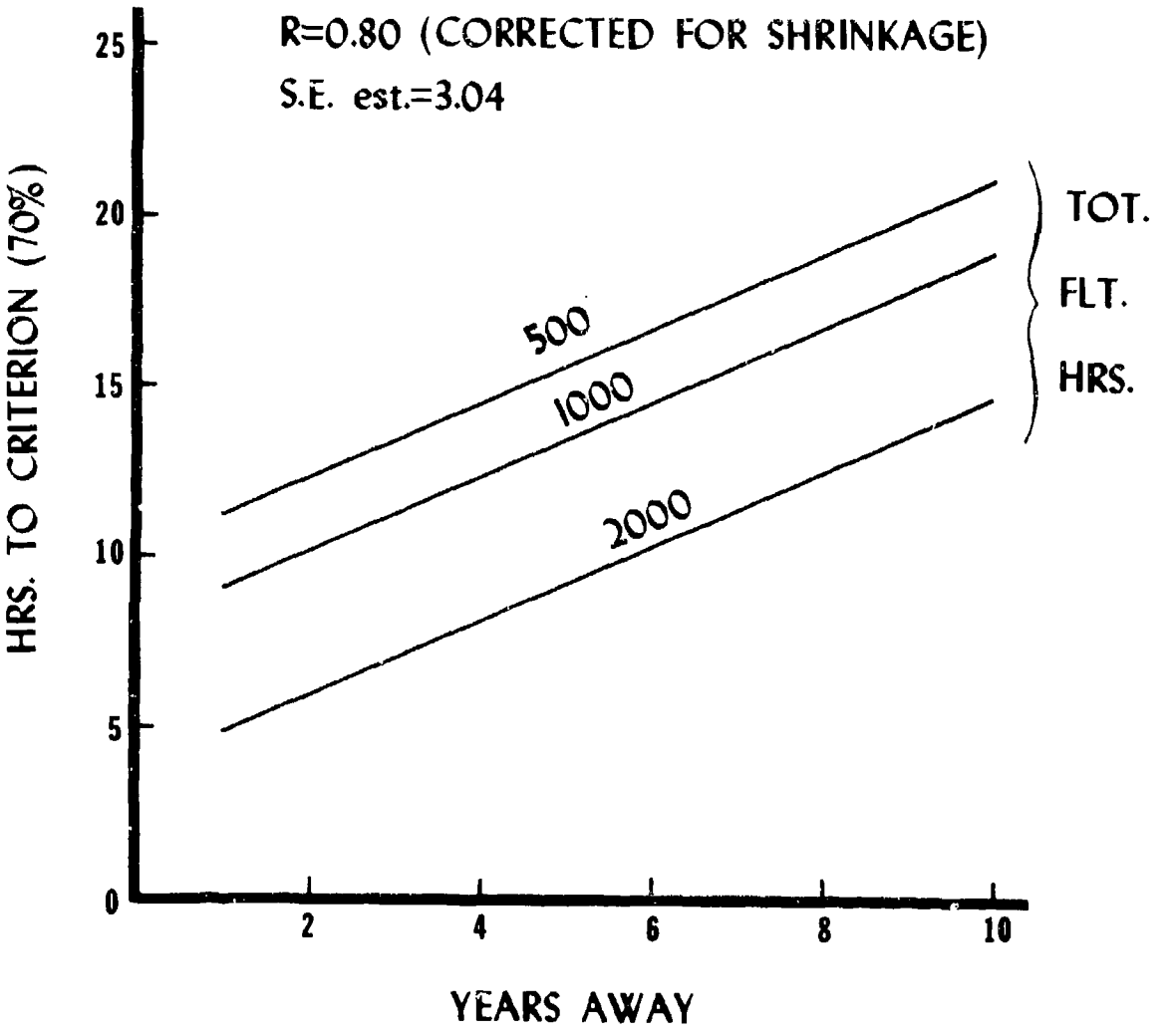

Figure 4. HOURS TO CRITERION (70%) BY TOTAL MILITARY FLIGHT HOURS AND YEARS AWAY

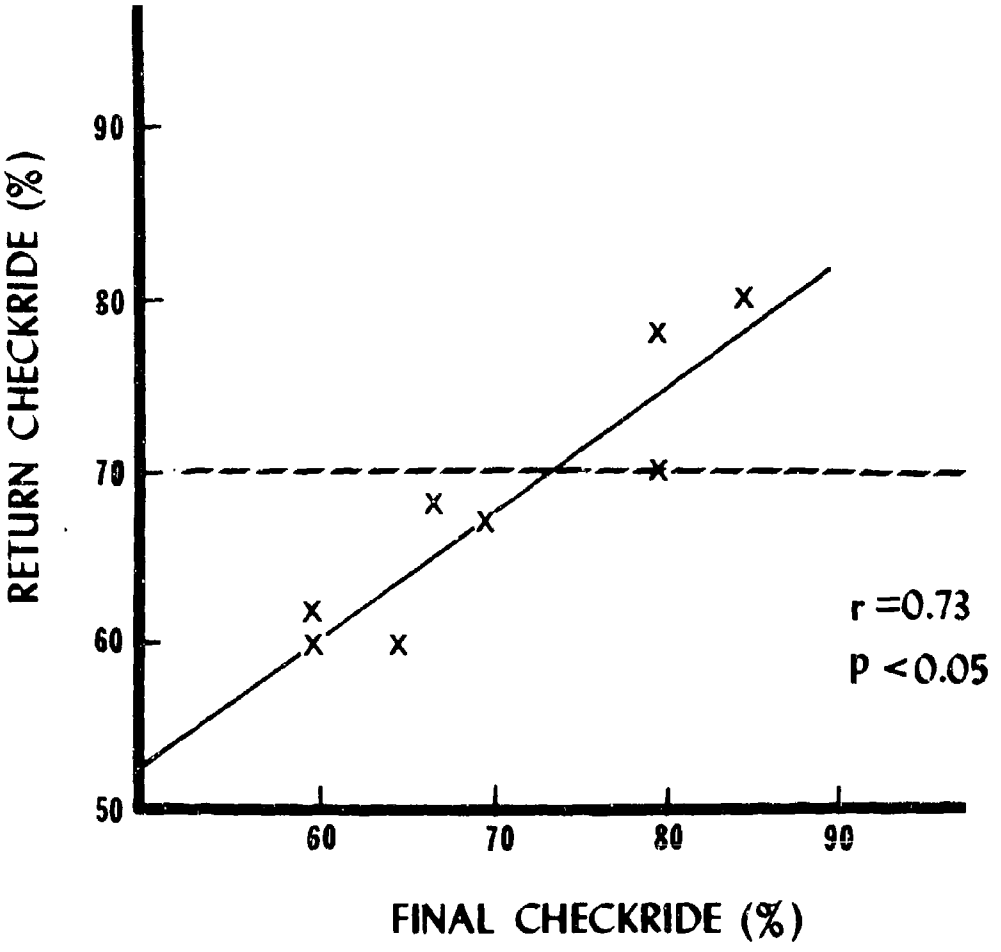

Figure 5. **RETURN CHECKRIDE VERSUS FINAL CHECKRIDE**

Table 4

Return and Final Checkride Scores

	Final	Return	Change
Average	75.6	68.1	-7.5
SD	6.2	7.7	
Range	60-85	60-80	
N	8	8	

A Pearson Product-Moment correlation between scores on Final and Return checkrides was positive:

$$r = 0.75 \ (p < 0.05)$$

k. Academic Tests. The three academic tests were originally produced in an open-ended format, but were later converted to a multiple-choice one ready for exporation to the field. The two versions are best considered separately. Twelve Reservists completed the open-ended version at a ten-day interval, whilst five completed the multiple-choice version at a seventeen-day interval. Half the Control Group (Warrant Officer Advanced Class) were given the open-ended version and half the multiple-choice one. The results from all these tests are summarized in Tables 5 and 6.

Table 5

Academic Tests (Open-ended)

		Aircraft Systems (Max = 100)	Aviation Knowledge (Max = 100)	Dead Reckoning (Max = 100)
Initial Tests	Av	34.0	34.3	36.2
	SD	13.7	12.8	14.1
	N	12	12	12
Final Tests	Av	71.8	78.3	76.0
	SD	11.6	9.2	11.3
	N	12	12	12
Control Group	Av	69.2	69.1	63.3
	SD	14.4	9.8	13.0
	N	15	15	15

Table 6

Academic Tests (Multiple Choice)

		Aircraft Systems (Max = 100)	Aviation Knowledge (Max = 100)	Dead Reckoning (Max = 100)
Initial Tests	Av	56.8	54.4	49.8
	SD	16.1	11.3	11.4
	N	5	5	5
Final Tests	Av	92.0	90.0	83.5
	SD	4.5	7.9	13.9
	N	5	5	5
Control Group	Av	77.5	82.2	66.4
	SD	12.2	4.9	9.2
	N	13	13	13

1. De-briefing. Reservists and IPs were de-briefed in separate groups. Many of the points raised concerned minor administrative matters within ARI or were suggested improvements to the Program which have already been effected. Therefore, only major comments regarding training are reported. Also included is a summary of the comments made on the gradeslips (R4057-2) by the Evaluators and IPs.

Evaluators and IPs' Comments

1. Overall, the Reservists' motivation appeared to be excellent, although some were reluctant to carry out much private study.

2. The main (and expected) deficiencies shown by a Reservist who had not flown for some time were a lack of control touch, slow cross-check, poor cockpit procedures, difficulty with the "autorotation with turn" and "hydraulics off" emergency maneuvers, and occasional under-confidence.

3. Several Reservists were using procedures appropriate to the last time they flew regularly (in Vietman), but which were at variance with School policy. A prime example was a much faster approach and takeoff then is now taught at USAAVNC.

4. Crowded stagefields and some lengthy transit flights necessitated less than optimum use of in-flight training time.

Reservists' Comments

1. Cockpit and emergency procedures were hard to recover; more static cockpit training was suggested as a remedy.

2. Over-controlling was a problem on the first few flights.

3. Many of the Reservists noted that the Army and certain flight procedures had changed considerably since they had left flying, and that they were often involved in a learning, rather than a relearning, situation.

4. The seminar format was a popular teaching technique.

5. More instruction on FM homing and map reading were requested.

6. In general, Reservists were very supportive of the Program, and opined that it was both effective and enjoyable. One complaint made by several Reservists was that the intensity of instruction was far greater than that to which they were accustomed in their civilian occupation; they felt that it took some time before they adapted to the pace and, consequently, did not benefit optimally from the early training days.

DISCUSSION

The three stated objectives of this part of the program, namely to determine the training required to bring a Reservist to criterion, to establish the influence of major variables and to produce a viable training and evaluation program,have been met. However, successful attainment of the longer-term objectives of the total program: to predict accurately the training required by any Reservist and to produce an effective training program for use wherever Reservists are trained, cannot yet be judged. Both the prediction algorithm and the training program are still being refined and integrated with data from the field; judgment as to their effectiveness must await a much larger data base.

Meanwhile, these preliminary findings have in turn been influenced by both the longer-term objectives and administrative constraints. Thus, the requirement to improve the training program on the basis of experience meant that it was not held constant during the experiment. Similarly, the academic tests were converted during the program to a form more suitable for export, checkrides were scheduled on a pre-arranged time rather than a readiness basis and Reservists were selected for the program according to their availability, rather than in carefully matched groups of high/low experience/years away, etc.

The criterion established by FORSCOM for this phase of training was success on an AAPART contact checkride, with a training priority of day, night, NOE, tactical instruments, and full instruments. In the limited time available, it was necessary to devote almost all the flying hours to reaching the AAPART criterion, and so the Reservists received only brief exposure to modes other than daytime contact flying. However, the availability of the SFTS meant that basic instrument and tactical instrument flying could, and did, receive more attention than either night or NOE work.

The measuring instrument used to determine whether the criterion had been reached was the best available: the judgment of DES SIPs. One caveat that must be noted is that the experience of the majority of these evaluators was with aviators who were at, or above, the criterion level and that they had relatively little experience with those who were way below this level. However, it must be noted that, even when working at this level, their estimates of the further hours required were good and borne out by subsequent events.

Administrative factors meant that checkrides were conducted at set times and not when it was thought that a Reservist was up to criterion. Thus, the determination of the hours required to bring a Reservist to criterion was an extrapolation in which a linear relationship between hours and score was assumed.

Such a measure should obviously be treated cautiously, but does provide a working figure which can be used until refined by further information. The distribution of the scores suggests that, for some purposes, the median may be a more useful descriptor than the mean.

From the literature it was expected that total military flight experience and years away from flying would be major determinants of the flight training hours necessary to reach criterion. (Prophet, op cit., Schendel et al, op cit.) However, the experiment was not designed to maximize the spread of these variables, but rather Reservists were allocated to ARI as they were available. In addition, total military flight hours is only one of several measures of experience that might have been used; e.g., fixed wing flying might have been excluded or early civilian flying included. Even so, both variables were shown to have important effects. The chart combining both variables (Figure 4), with its assumptions about linearity and non-interaction, is undoubtedly greatly over-simplified and must be refined by further work. But even at this stage it may be useful; for if a unit in the field could say in advance that it would not be able to provide a Reservist with the hours predicted for him, a decision could be made to postpone his tour or to re-allocate him to another unit.

Other variables, such as whether or not the Reservist had been a school-trained IP, the nature of his intervening activities, and the rate of change of Army aviation since he left flying, may well prove to have a considerable effect on his level of performance and subsequent learning rate. Data from a larger population of IRR aviators (Allnutt, op cit.) show that these 17 Reservists had lower total flight hours than the general population, though they had been away from flying for about the same length of time. Thus, the average hours to reach criterion for the whole IRR population (UH-1) may be slightly lower than the 13.3 hours predicted in this paper. On the other hand, the Reservists trained in this experiment were in the aircraft while their partner was being trained and so may have benefited from incidental learning, thus making the 13.3 hour figure a little optimistic.

One very important piece of information which will be needed to determine refresher flying schedules is the extent to which relearned skills are maintained. The return of the Reservists after a 3-5 month interval indicated that there was some decay of both skills and procedures and that the returning level was, as would be expected, related to the level obtained in the final checkride. It is planned that further experimentation should be conducted to investigate returning level and speed of subsequent recovery of skill and knowledge over a series of time intervals. One factor which may have influenced the present data is that several Reservists encountered marginal weather conditions (considerable turbulence) on their return checkride, while their final checkride had been carried out in good weather conditions. This may have magnified the drop in performance.

The Academic Tests were constructed hastily, and without adequate validation or matching, to provide an indication of a returning aviator's knowledge and learning ability. Results showed that the initial level was low, but that an

intensive training program (but one which did not necessarily teach the tests) could boost this to an acceptable level in about nine days and also enable the Reservists to pass the oral part of the checkride. This training was partly to revive dormant knowledge and partly to impart new knowledge about systems that had changed during the time that the Reservists had been away from flying.

Apart from a certificate issued to some of the Reservists who trained later in the program, the performance of both the Reservists and the Control Group was motivated by nothing more than personal satisfaction, encouragement from the IPs, and perhaps intra-group competition. In the de-briefs, the Reservists reported that they had enjoyed the program and the IPs opined that the Reservists' motivation had been good. Thus, there is no reason to suppose that offering incentives, such as extra money or retirement points for passing the checkride (even if such a scheme was possible), would have altered the level of performance significantly.

Apart from a plethora of administrative details, which have been taken up with the relevant authorities, the main comments made about the program to recover flying skills were ones which were anticipated. Nevertheless, in an important field where so little evidence is available, they may bear repeating. Thus the main deficiencies of a returning aviator were a slow cross-check, inadequate cockpit and emergency procedures, initial over-controlling, difficulty with autorotations with turn and anti-torque system failures, occasional under-confidence, and maneuvers conducted too fast in an adequate (for Vietnam), but non school-approved manner.

CONCLUSIONS

1. An average of just over 13 flight training hours was required to bring a representative sample of IRR UH-1 aviators up to an AAPART contact checkride standards.

2. The hours required correlated negatively with total military flight hours and positively with years away from flying.

3. The skills which had deteriorated most were the expected ones of a slow cross-check, inadequate cockpit and emergency procedures, and certain emergency maneuvers. Many maneuvers were conducted too fast in an adequate (for Vietnam), but non school-approved manner.

4. Initially, academic knowledge was poor, but was brought up to the level of an Active Army control group after about nine days of intensive training.

5. There was some loss of flying skills and knowledge on re-testing 3-5 months later, but more data are required before any firm predictions can be made.

6. An intensive, practical and exportable training and evaluation program was produced and has, subsequently, been sent to units in the field. An assessment of its effectiveness must await the acquisition of a large data base.

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APPENDIX A

TRAINING IRR AVIATORS FOR THE ATTACK MISSION

William R. Bickley, Ph.D.

INTRODUCTION

In coordination discussions of the overall IRR aviator investigation with FORSCOM representatives, a separate area of concern arose: in the near-term future, the Army is faced with a projected critical shortfall of attack-rated aviators. The suggestion was put forth that, as a possible "quick fix" for this shortfall, the feasibility of training IRR UH-1 aviators to function as AH-1 co-pilot/gunners be investigated. The basis for the suggestion is outlined below.

The Army's primary attack platform, the AH-1 helicopter, is manned by a crew of two attack-rated aviators: the pilot (P) and the co-pilot/gunner (CP/G). Primary aircraft controls are in the P's cockpit, and primary weapons controls are in the CP/G's cockpit. Although the aircraft may be flown from the CP/G position, during most attack profiles the aircraft is flown by the P and the weapons systems operated by the CP/G. Thus it is the case that in most instances, the CP/G, an attack-rated aviator is not required to use flying skills and could, in fact, possibly be replaced by a "generic" rotary-wing aviator trained in the AH-1 gunnery tasks.

The IRR UH-1 aviator is a logical candidate for this "generic" aviator. He has the basic helicopter skills which should allow him to perform rudimentary flight tasks from the CP/G position, and he is available for gunnery training. But training is an expensive operation, not only in terms of direct cost, but also in terms of diversion of personnel and equipment at the unit level. So, for training IRR aviators as AH-1 CP/Gs, it was decided to use the AH-1 flight and weapons systems simulator (AH1FS) located at USAAVNC. The AH1FS Operational Test II results (Bridgers, Bickley, Maxwell, 1980) indicate the simulator to be almost completely effective in training gunnery skills, and its proposed basis of issue plan will eventually make it available for training at the unit level.

It was realized early on that the proposed investigation would be accomplished under several limitations. The AH1FS would be available on a limited basis due to its high utilization rate in the on-going USAAVNC AH-1 transition course. The IRR students themselves would be available on a limited basis since their primary objective at Fort Rucker was to be re-qualified in the UH-1. There was only vague guidance as to the tasks to be trained and no extant curriculum tailored to the IRR aviator's peculiar training situation. Finally, the same cost considerations that prohibited training in the AH-1 aircraft also prohibited training validation in the aircraft; any validation of training effectiveness would perforce be accomplished in the AH1FS. Within these general limitations, the feasibility demonstration was carried out as described below.

METHOD

a. Curriculum Development

It was found that the availability of the AH1FS would allow, at most, training for 3 students per group of IRR aviators for a maximum of 4 hours apiece. Under this overall restriction the following curriculum was devised.

(1) Contact flight. It is envisioned that the CP/G would be called upon to use his flight skills only in case of incapacitation of the P. In such a situation, the CP/G's task would be primarily either to land immediately or to return immediately to base. In either case, the flight tasks most likely required would be (1) hover flight, (2) landing from a hover, (3) terrain flight, and (4) terrain flight approach. These were the contact maneuvers chosen to be taught to the IRR aviators in the AH1FS.

(2) Gunnery training. It was decided that CP/G weapons delivery training would be given in all gunnery systems except the 2.75" rockets, which are controlled from the P's position. This training covered the turret-mounted 7.62mm "minigun," the 40mm automatic grenade launcher, the 20mm cannon and the airborne TOW anti-tank missile. All turret firing was done from a hover against stationary targets. TOW training was conducted against stationary and moving targets at intermediate ranges (2000-2800m).

The gunnery POI was continually revised as training proceeded and appears in its final form in the Appendix.

b. Subjects

A total of 8 IRR aviators participated: 2 from the pilot study, 3 from the next group, and 3 from the one after. All had just completed UH-1 requalification. One had had previous experience with the AH-1 as a maintenance officer.

The instructor pilot (IP), who was both an AH-1 flight instructor and airborne TOW instructor, was assigned from the Scout/Attack Branch of the Hanchey Division of the Department of Flight Training of the USAAVNC Directorate of Training.

c. Procedure

The aviators received approximately 5 hours academic instruction in gunnery, 4 hours gunnery system training in the AH1FS, and 2.4 hours rudimentary AH1FS flight training. Simulator training was done in individual periods of 1.5 hours or less. The last AH1FS training period was a check "flight" in which the weapons systems were fired for score.

RESULTS

a. Contact Flight

As indicated above, because of lack of access to AH-1 aircraft, it was not possible to validate the AH1FS's effectiveness as a training device for IRR aviators. The IP reported that all but one aviator experienced difficulty in controlling the AH1FS in maneuvers near the ground (hover flight and landing from a hover). The IP and students were of the opinion that the difficulties arose more from the AH1FS CP/G's restricted field of view (36^{o} vertical x 48^{o} horizontal) than from student flight deficiencies. All were of the opinion that, after AH1FS training, they could learn the restricted set of maneuvers examined here in the aircraft in less than 2 hours flight time.

b. Gunnery

The results of the gunnery check-rides are shown in Figure A-1. Gunnery in the AH1FS is scored in terms of number of rounds impacting simulated 10x8m targets; proficiency in Figure 1 is represented by proportion of hits per rounds fired as a function of total training time with each weapons subsystem.

DISCUSSION

a. Contact Flight

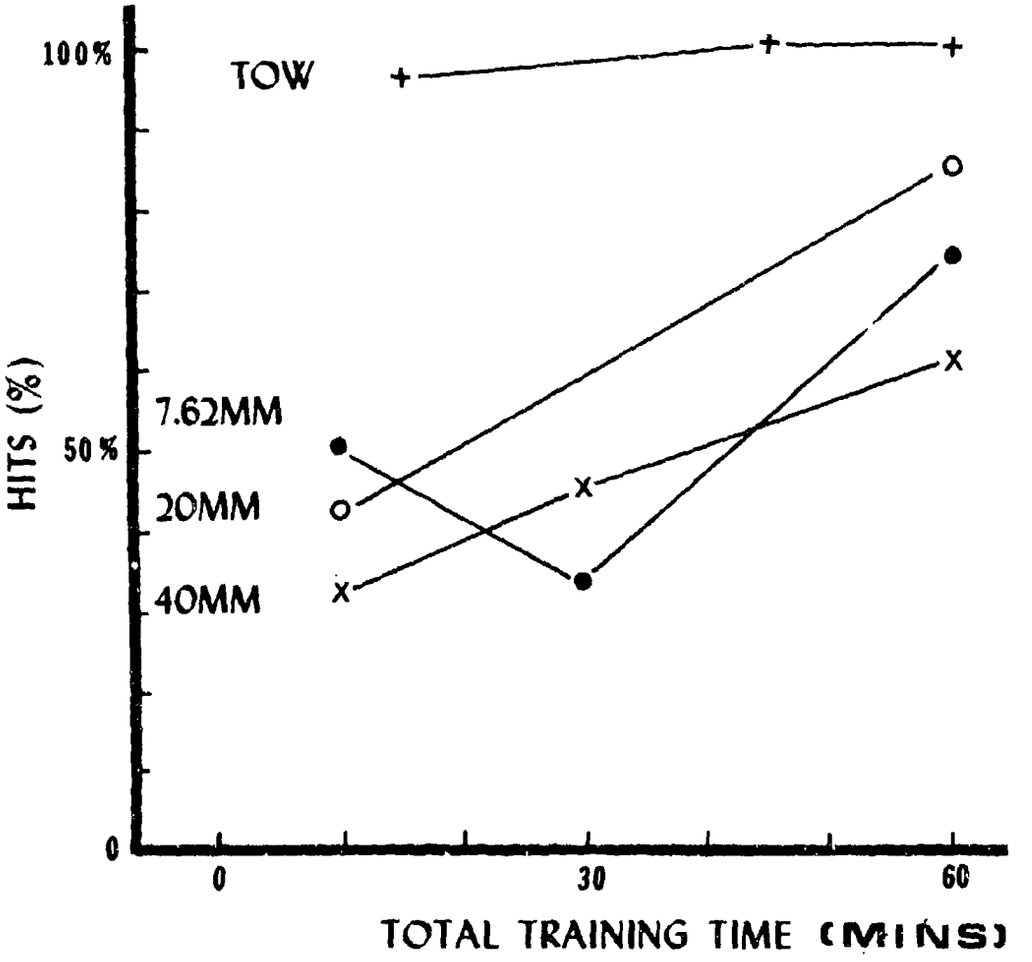
From the results of this demonstration, it appears that the AH1FS in training IRR CP/Gs flight skills can be most effectively employed in training those tasks that do not depend heavily on peripheral visual cues. These would include straight and level, low-level, and contour flight; climbs and descents; acceleration and deceleration; and initiating straight-in approaches. Tasks requiring hovering or turns (such as hover flight or traffic patterns) would most likely be more effectively trained in the AH-1 aircraft.

b. Gunnery

The gunnery results in Figure A-1 indicate that after about 45 minutes training, the IRR aviator can attain in the AH1FS a hit probability (p(H)) in excess of 50%. Results obtained in the OT II of the AH1FS (Bridgers, et al, op cit) indicate that the gunnery skills learned in the simulator transfer almost directly to the aircraft. Thus, although the IRR aviators' gunnery proficiency was not aircraft-validated, it is most probable that their p(H) in the aircraft after 45 minutes AH1FS training would also be in excess of 50%.

c. General Considerations

It appears that IRR aviators can be trained as CP/Gs using the AH1FS. However, it should be kept in mind that the effectiveness of the simulator remains conjectural; this demonstration involved only 8 aviators and none of the training was validated in the aircraft. This is an obvious next step for the IRR re-training study.



RANGES:

TOW:	2-2.8KM (MOVING TARGET)
7.62MM:	1000-1500M
20MM:	1500-2500M
40MM:	1000-1500M

Figure A-1. FINAL GUNNERY PROFICIENCY

There are additional considerations in training; if IRR aviators are to be trained as CP/Gs, the following must also be addressed:

(1) Advanced gunnery. Only individual gunnery and hover fire were addressed. As a minimum, running fire and crew gunnery should also be addressed.

(2) Cockpit teamwork. Operationally, P and CP/G function as a unit, especially in the area of target acquisition and hand-off. It is essential to the attack mission that the aircrew be an integrated functional team.

(3) Attack tactics. No attempt was made to teach attack tactics. This is an obvious training need, especially in the area of high threat environment tactics.

(4) Knowledge of pilot's tasks and aircraft systems. Both the IP and the Reservists felt the CP/G should have at least academic knowledge of the P's flight tasks. If the IRR CP/G is to take control of the aircraft in emergencies involving the P, it is essential he understand the aircraft systems and their interactions.

(5) Tactical NOE navigation. On a tactical mission, in most cases the CP/G functions as navigator. Some IRR aviators have no NOE navigation training and none have NOE experience in the AH-1.

Overall, it can be seen that, although the basic skills of placing ordnance on target are easily trainable, there is a great deal of follow-on training that must be accomplished by the IRR aviator's receiving unit if he is to be trained as a functional CP/G. A research plan for an investigation of other aspects of the CP/G task has already been submitted to the appropriate authorities.

CONCLUSIONS

1. Data from the initial investigation support the feasibility and practicality of converting an IRR UH-1 aviator into the AH-1 CP/G role.

2. Further, and wider-ranging, data on all aspects of the CP/G's task are required together with validation of these findings in the aircraft. A larger-scale investigation to obtain these data has been proposed.

REFERENCE

Bridgers, J. D., Bickley, W. R., and Maxwell, W. G. Operational Test II of AH-1Q flight and weapons systems simulator (OT II AH1FS): Final test report. Fort Rucker, AL: United States Army Aviation Board, January, 1980.

APPENDIX B - INTERIM GUNNERY POI

Texts Used: (1) Dept. of the Army
Cobra-TOW Net Team
Lesson Plan, June 1976

(2) USAAC Reference Book
AH-1S Cobra-TOW in
Support of W3, April 1977

(3) TM 55-1520-236-10
Operator's Manual, AH-1S
April 1977

Day 1 -	Film Cobra-TOW, (Intro.) Film No. SF 46-354	18 min.
	1. Abbreviations/acronyms Introduction to the TOW Missile Subsystem	5 min.
	2. XM65 Objectives	5 min.
	3. Cobra/TMS Capabilities 4. Cobra/TMS TSU	5 min.
	5. System Characteristics 6. Pilot's Steering Indicator (PSI) 7. Pilot's Armament Control Panel (PACP) 8. Pilot's Missile Status Panel (MSP) 9. Gunner's Armament Control Panel (GACP) 10. Cyclic Grips 11. TOW Control Panel (TCP)	27 min.
	Classroom Time	1.0 hrs.
	Simulator Period (Front Seat on Controls Terrain Flt)	1.0 hrs.
	" " (Observing other pilot's front seat time)	2.0 hrs.

Day 2 -	Film Helicopter versus Tanks (Ansbach)	Film Time Unknown
	1. Introduction to and Description of HSS	15 min.
	2. Armament System Block Diagram 3. Interface Control Unit (IFCU) 4. Relay Bank 5. M28A1E1 Armament Subsystem 6. Gunner's Armament Control Panel 7. Pilot's Armament Control Panel 8. Turret Movement/Limitations 9. Electronic Components Assembly (ECA)	5 min. 30 min.
	10. Helmet Sight Assembly 11. Helmet Sight Subsystem	10 min.
	Classroom Time	1.0 hrs., plus film time
	Simulator Period (Front Seat at the Controls)	1.0 hrs.
	" " (Observing other Pilot's/Some back-seat time)	2.0 hrs.
	" " (Run-up Checks of HSS)	1.0 hrs.

Day 3 - TOW Missile System (TMS)

1.	Discription and Operation	10 min.
2.	Telescopic Sight Unit (TSU) (a) 13X Reticle (b) 2X Reticle	5 min.
3.	Sight Hand Control (SHC)	5 min.
4.	TOW Control Panel (TCP)	5 min.
5.	Built-in Test (BIT)	5 min.
6.	Pilot Steering Indicator (PSI)	5 min.
7.	Pilot's Missile Status Panel (MSP)	5 min.
8.	Stablization Control Amplifier	5 min.
9.	Missile Command Amplifier	5 min.
10.	Electronic Power Supply	5 min.
11.	TOW Missile Launcher (TML)	5 min.
Classroom Time		1.0 hrs.
Simulator Period	(Front Seat)	1.0 hrs.
"	" (Observing - of which 1.0 hrs. is back-seat time)	2.0 hrs.
"	" (Run-up Checks HSS and TOW System)	1.0 hrs.

Day 4 - TOW Missile

1.	TOW Missile Tabulated Data	5 min.
2.	TOW Missile Components	15 min.
	(a) Weapons	
	(b) Electronic Section	
	(c) Flight Motor/Launcher Motor	
	(d) Wings and Flight Motor Aft CASG	
	(e) Control Section	
	(f) Aft Section	
3.	TOW Missile Container	15 min.
4.	TOW Missile Time/Sequence/Distance	15 min.
5.	TOW Launch and Capture Geometry	10 min.
Classroom Time		1.0 hrs.
Simulator Period	(Front Seat)	1.0 hrs.
"	" (Run-up HSS and TSO BIT)	1.0 hrs
"	" (Observing - of which 1.0 hrs is back-seat time)	2.0 hrs

Introduction to the TOW Missile Subsystem (TM)
43-1863-1, August 1979 50 min.
18 min. Film Intro. TOW Cobra SF 46-354
1.08 min.

TMs Unit Description, Location, Function, and Operation
43-1864-5, Sep. 1979 4.50 min.

Introduction to and Description of HSS
43-1867-1, Oct. 1979 1.00 min.

6.58 min. TOTAL TIME

APPENDIX C

As a minimum, IRR aviators should be proficient in the following tasks:

TASK NUMBER (from TC 1-135)	TASK NAME
1003	Interpret Aviation Weather Reports
1005	Use DOD Flip VFR Supplement
1008	Determine Criteria for Approval of Flight Plans
1013	Determine Necessary Weather Minimums for VFR Flights
1014	Prepare and File a VFR Flight Plan
1015	Determine the Fuel Requirements for IFR Flight Plans
1016	Prepare DD Form 365-F
1017	Use DA Form 2696 - Operation Hazard Report (OHR)
1018	Prepare Performance Planning Card
1501	Perform Preflight Inspection
1502	Perform Engine Start/Run-up Procedures
1503	Perform Before Takeoff Check
1504	Perform Engine Health Indicator Test (HIT)
2001	Perform Takeoff to a Hover
2002	Perform Hover Checks
2003	Perform Hovering Turns
2004	Perform Hovering Flight
2005	Perform Landing from a Hover
2501	Perform Normal Takeoff
2502	Perform Maximum Performance Takeoff
3001	Perform Straight and Level Flight
3002	Perform Climbs and Descents
3003	Perform Turns
3004	Perform Acceleration/Deceleration
3005	Perform Traffic Pattern Flight
3501	Perform Before Landing Check
3502	Perform Normal Approach
3503	Perform Shallow Approach
3504	Perform Steep Approach
3505	Perform Go-around
4001	Perform Hovering Autorotation
4002	Perform Standard Autorotation
4003	Perform Standard Autorotation with Turn
4004	Perform Low-level Autorotation
4005	Perform Simulated Hydraulic System Malfunction
4006	Perform Simulated Antitorque Malfunction
4007	Perform Manual Throttle Operation, Emergency Governor Mode
4008	Perform Simulated Engine Failure at Altitude
4009	Perform Simulated Engine Failure from Hover Altitude
4010	Perform Simulated/Oral Emergency Procedures
5013	Perform Confined Area Operations
5014	Perform Slope Operation
5015	Perform Pinnacle/Ridgeline Operation
6501	Perform Aircraft Shutdown
6502	Perform Walk-around Inspection

APPENDIX D FLIGHT SKILLS RATING FORM

1. IRR Aviator's Name:

   (Last)_____(First, M.I.)_____(Rank)_____

2. Evaluator's Name:

   (Last)_____(First, M.I.)_____(Rank)_____

3. Evaluator's Unit_____

4. Unit Location_____Unit Phone (AV)_____

5. Today's Date_____

6. Date of Flight Being Rated_____

Use the following scale for Column 7:

N.O. - Not Observed

0 - Skill or knowledge of procedures totally absent.

1 - Unable to perform without instructor assistance-unsafe in each attempt.

2 - Can perform on some attempts but not consistently, needs further training.

3 - Rough or slow but can muddle through to a satisfactory outcome.

4 - Performs at an acceptable level - not unsafe, but room for improvement.

5 - Proficient - unquestionably safe, no improvement needed.

Activity	(7) Skill Level	(8) Estimated number of iterations required to meet AAPART standard (70%)
1. Preflight planning		
Comment -		
2. Preflight inspection		
Comment -		
3. Engine run-up		
Comment -		

APPENDIX D (CONT'D)

Activity	(7) Skill Level	(8) Estimated number of iterations required to meet AAPART standard (70%)
4. Engine shut-down		
Comment -		
5. Radio use (tuning, voice comm)		
Comment -		
6. Hovering operations (T/O, lndg, turns, taxi) . . .		
Comment -		
7. Normal T/O		
Comment -		
8. Normal approach		
Comment -		
9. Simulated maximum performance T/O		
Comment -		
10. Steep approach		
Comment -		
11. Traffic pattern		
Comment -		
12. Tactical inst. nav. (NDB & Dead Reckoning)		
Comment -		
13. Simulated systems mulfunctions:		
a. Straight-in autorotation		
Comment -		
b. Low level autorotation		
Comment -		
c. Autorotation from a hover		
Comment -		

APPENDIX D (CONT'D)

Activity	(7) Skill Level	(8) Estimated number of iterations required to meet AAPART standard (/0%)
d. Autor ation with turn		
Comment –		
e. Hydraulic system malfunctions		
Comment –		
f. Antitorque failure . . . Right pedal		
Left pedal		
Comment –		
g. Emergency governor operations		
Comment –		
h. Other system malfunctions		
Comment –		
14. Nap-of-the-Earth (NOE) maneuvering		
Comment –		
15. NOE navigation		
Comment –		
16. Maximum load operations . . . Internal		
External		
Comment –		
17. Confined area operations		
Comment –		
18. Pinnacle operations		
Comment –		
19. Slope operations		
Comment –		

APPENDIX E

DAY	MORNING	AFTERNOON	EVENING
1	In-processing/Orientation	3 Academic Test (unlimited time)	
2	Entry Evaluation Flight (1.5 hrs)	Intro. to -10 & ATM (1.5 hrs) - Ref.#1 Performance Charts (2 hrs) - Ref. #2 - - - - - - - - - OR - - - - - - - - - Self-study of above (3.5 hrs) - Ref#1&2	Self-study, as required
3	Pre-flight Review (2 hrs) Ref. #3 | Cockpit Familiarization (2 hrs) Ref. #4	Emergency Procedures (3 hrs) - Ref. #5 - - - - - - - - - OR - - - - - - - - - Self-study of above (3 hrs) - Ref. #5	Self-study, as required
4	Contact Flight I (1.5 hrs)	Basic Instruments (2 hrs) Ref. #6 | AR 95-1 (2 hrs) Ref. #7 - - - - - - - - - OR - - - - - - - - - Self-study of above (4 hrs) - Ref.#6&7	Self-study, as required
5	Weight & Balance (2 hrs) Ref. #8 | Directed Study (2 hrs) Ref. #9 - - - - - - - - - OR - - - - - - - - - Self-study of above (4 hrs) Ref. #8&9	SFTS I (Starting/run-up procedures & Basic Instruments) (1.5 hrs)	Self-study, as required
6	Contact Flight II (1.5 hrs)	Aerodynamics (2 hrs) Ref. #10 | Directed Study (2 hrs) Ref. #9 - - - - - - - - - OR - - - - - - - - - Self-study of above (4 hrs) Ref. #9&10	Self-study, as required
7	NOE Orientation (1.5 hrs) Ref.#11 | Tactical Instruments (2 hrs) Ref. #12 - - - - - - - - - OR - - - - - - - - - Self-study (3.5 hrs) Ref. #11 & 12	SFTS II (Starting/Run-up Procedures, Basic Instruments and Emergency Procedures) (1.5 hrs)	Self-study, as required

APPENDIX E (Cont'd)

DAY	MORNING	AFTERNOON	EVENING
8	Contact Flight III (1.5 hrs)	Navigational Computer (2 hrs) Ref. #13 | Directed Study (2 hrs) Ref. #9 - - - - - - - - - - OR - - - - - - - - - - Self-study of above (4 hrs) Ref. #9&13	Self-study, as required
9	Contact Flight IV (1.5 hrs)	SFTS III (Basic Instruments, Emergency Procedures and ADF Flight Procedures) (1.5 hrs)	Self-study, as required
10	Contact Flight V (1.5 hrs)	Threat & Doctrine (2 hrs) Ref. #14 | AN/APR 39 (1.5 hrs) Ref. #15 - - - - - - - - - - OR - - - - - - - - - - Self-study of above (3.5 hrs) Ref. #14&15	Self-study, as required
11	Contact Flight VI (1.5 hrs)	SFTS IV (Basic Instruments, Emergency Procedures and ADF Flight Procedures) (1.5 hrs)	Self-study, as required
12	Contact Flight VII (1.5 hrs)	General Review (3 hrs) Ref. #16 - - - - - - - - - - OR - - - - - - - - - - Self-study of above (3 hrs) Ref. #16	Self-study, as required
13	Contact Flight VIII (1.5 hrs)	SFTS V (ADF Flight Procedures and Tactical Instrument Maneuvers) (1.5 hrs)	Self-study, as required
14	Contact Flight IX (1.5 hrs)	Review of Tac. Instr. Planning (1 Hr) Ref. 17 | NVG Orientation (1.5 hrs) Ref. 18 | Night Flight (1.5 hrs) Ref. 19 - - - - - - - - - - OR - - - - - - - - - - Self-study of above (4 hrs) Ref. 17,18&19	Self-study, as required

APPENDIX E (Cont'd)

DAY	MORNING	AFTERNOON	EVENING
15	Crew Rest	Contact Flight X (1.5 hrs)	Night Flight (1.5 hrs)
16	Crew Rest	SFTS VI (Tactical Instrument Evaluation) (1.5 hrs)	Self-study, as required
17	Contact Flight XI	General Review (3 hrs) Ref. #20 - - - - - - - - - - OR - - - - - - - - - - Self-study of above (3 hrs) Ref. #20	Self-study, as required
18	Exit Evaluation Flight (1.5 hrs)	Self-study, as required	Self-study, as required
19	3 Academic Tests (unlimited time)	Out-processing	